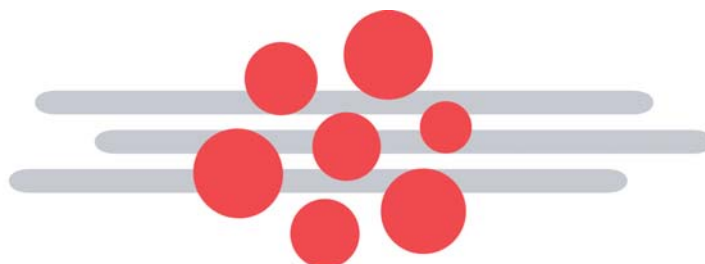


Appendix D

# Project Quality Assurance Program (PQAP)



Center for Functional Nanomaterials  
Brookhaven National Laboratory

Effective Date: Mar. 1, 2004  
Rev. 0

Controlled Copy No. 1

**BNL Center for Functional Nanomaterials**  
Basic Energy Sciences

**Project Quality Assurance Program (PQAP)  
for the  
Center for Functional Nanomaterials (CFN)**

**At  
Brookhaven National Laboratory (BNL)  
Upton, New York**

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March 2004



## **TABLE OF CONTENTS**

<b>ACRONYMS.....</b>	<b>4</b>
<b>INTRODUCTION .....</b>	<b>5</b>
<b>PROJECT QUALITY ASSURANCE PROGRAM (PQAP) .....</b>	<b>13</b>
<b>Criterion 1 – Program .....</b>	<b>14</b>
<b>Criterion 2 - Personnel Training and Qualification .....</b>	<b>16</b>
<b>Criterion 3 – Quality Improvement .....</b>	<b>19</b>
<b>Criterion 4 - Documents and Records .....</b>	<b>21</b>
<b>Criterion 5 - Work Processes.....</b>	<b>23</b>
<b>Criterion 6 - Design.....</b>	<b>26</b>
<b>Criterion 7 - Procurement .....</b>	<b>28</b>
<b>Criterion 8 - Inspection and Acceptance Testing.....</b>	<b>31</b>
<b>Criterion 9 - Management Assessment.....</b>	<b>33</b>
<b>Criterion 10 - Independent Assessment .....</b>	<b>34</b>
<b>Appendix 1: Design Team Program for Quality.....</b>	<b>A-1</b>

## **FIGURES**

<b>Figure 1: Center for Functional Nanomaterials (CFN) Work Breakdown Structure (WBS) .....</b>	<b>11</b>
<b>Figure 2: Center for Functional Nanomaterials (CFN) Project Organization.....</b>	<b>12</b>
<b>Figure 3: EP’s Applicable Supplemental Procedures to SBMS Matrix.....</b>	<b>36</b>

## ACRONYMS

A/E	Architect/Engineer Firm
BNL	Brookhaven National Laboratory
CFN	Center for Functional Nanomaterial Project
CFR	Code of Federal Regulations
CMS	Chemical Management System
EP	BNL Plant Engineering Division
ESH&Q	Environment, Safety, Health And Quality
IAP	Integrated Assessment Program
ISM	Integrated Safety Management System
JTA	Job Training Assessment
LCAM	Life Cycle Asset Management
ORE	Operational Readiness Evaluation
NC	Nanoscience Department
PAAA	Price-Anderson Amendments Act
PEP	Project Execution Plan
PQAP	Project Quality Assurance Program
QA	Quality Assurance
QAP	Quality Assurance Program
QMO	Quality Management Office
QMS	Quality Management System
QR	Quality Representative
R2A2	Roles, Responsibilities, Accountabilities, and Authorities
RPAM	Real Property Asset Management
SBMS	Standards Based Management System
SA	Subject Area
TEC	Total Estimated Cost
WBS	Work Breakdown Structure
WP&C	Work Planning and Controls

## **INTRODUCTION**

The CFN project (CFN in this document) will be conducted in accordance with BNL's lab-wide Quality Assurance Program (QAP) which applies to all work conducted at BNL. The CFN Project Quality Assurance Program (PQAP) will describe how the CFN implements the BNL QAP. Also, DOE M 413.3-1, "Project Management For The Acquisition Of Capital Assets", was used to provide guidance in developing this PQAP.

The BNL Quality Assurance Program (QAP) was developed to support Brookhaven National Laboratory's quest for scientific excellence. It evolved from NQA-1 Quality Assurance requirements for Nuclear facility application and then progressed using the DOE G 414.1-2, "Quality Assurance Management System Guide for Use with 10 CFR 830 Subpart A and DOE 414.1A", as well as the Baldrige Criteria for Performance Excellence. Using these consensus standards as tools in the development of this program ensures the delivery of a robust, process-based, Quality Program that meets DOE's requirements and supports the CFN Mission.

### **Center for Functional Nanomaterials Mission**

Brookhaven National Laboratory's role is to produce excellent science and advanced technology for the DOE in a safe, environmentally benign manner with the cooperation, support, and appropriate involvement of our scientific and local communities. The Laboratory supports DOE's strategic missions, one of which is:

- To conceive, design, construct, and operate complex, leading-edge, user-oriented facilities in response to the needs of DOE and the international community of users.

In support of this DOE strategic mission, the Center for Functional Nanomaterials (CFN) at Brookhaven National Laboratory will provide state-of-the-art capabilities for the fabrication and study of nanoscale materials, with an emphasis on atomic-level tailoring of nanomaterials to achieve desired properties and functions. Its focus is to achieve a basic understanding of how functional materials, which exhibit a predetermined chemical or physical response to external stimuli, respond when in nanoscale form. As a premier user facility for conducting interdisciplinary research on a variety of functional nanomaterials, the CFN will serve as a focal point and enabler of advanced materials research in the northeastern United States.

## **Approach**

All BNL organizations use a management approach called the Standards-Based Management System (SBMS), whereby all functions of the Laboratory are defined within a finite set of fully integrated Management Systems, including a [Quality Management System](#) (QMS).

The CFN Project will be the responsible organization for implementing SBMS requirements for all project activities through completion of conventional construction (CD4a). Starting with subsequent installation of technical equipment, the Nanoscience Department (NC) will provide additional SBMS-defined mechanisms for installation, testing, and commissioning of scientific equipment in the building. A building manager will be appointed, and work planning controls will be in place for hookups and installation. An Operational Readiness Evaluation (ORE) process (per the [Operational Readiness Evaluation \(ORE\)](#) SA), concurrent with an Experimental Safety Review, will ensure that experimental apparatus is brought online safely, and with environmental compliance assured. Since the CFN Director is also the Chair of the NC department, a coordination of responsibility between the CFN and NC entities will be facilitated.

## **Lab-Wide SBMS**

Each Management System is assigned a System Steward (typically a Level 1 Manager), who documents the system functions, processes, and products within a Management System Description. These System Descriptions are delivered online via the SBMS. The Standards-Based Management approach provides the "total quality management," "process-based" systematic structure within BNL for the continuance of "world class" research in developing and delivering quality products and services, in a safe, reliable, and environmentally sound manner. These management processes and functions are integrated into SBMS documents, i.e., Management System Descriptions, Program Descriptions, Subject Areas, and Manuals. The SBMS [Standards of Performance](#) states, "All staff and guests shall comply with applicable Laboratory policies, standards, and procedures, unless a formal variance has been obtained." The basic premise of SBMS is that work is a process that can be effectively planned, performed, controlled, assessed, and improved.

In addition to providing quality-specific expertise and processes, the Quality Management System is chartered to deliver and maintain a Quality Assurance Program Description which describes how various management system processes and functions

provide for a Laboratory management approach which conforms to the basic requirements defined in the DOE Order 414.1A, "Quality Assurance", and 10 CFR 830 Subpart A, "Quality Assurance Requirements".

BNL's QA Program Description describes the manner in which BNL's Management Systems provide the integrated systematic processes through which all work is performed at the Laboratory. Activities are performed in a framework consistent with DOE Order 414.1A and 10 CFR 830 Subpart A. whereby work can be mapped into Management, Performance, and Assessment elements. Each element has several functional criteria that collectively comprise the mechanisms and processes by which BNL meets the requirements of DOE Order 414.1A and 10 CFR 830 Subpart A. These collective Standards-Based Management processes and mechanisms are referred to as the BNL "QA Program."

### **Consistency Between the Quality Assurance Program and the Integrated Safety Management (ISM) Program**

BNL used the cross-reference between the ISM Principles and Functions and the QA Criteria provided in the DOE Guide 414.1-2, to aid in developing the BNL QA Program. As a result, the work undertaken to develop the BNL Quality Assurance Program Description specifically focuses on ensuring appropriate integration, consistency, and mutual support between the QA and ISM Programs as envisioned in the guidance provided in DOE G 414.1-2.

### **Graded Approach**

A key element of the QAP is the concept of "Graded Approach"; that is, applying an appropriate level of analysis, controls, and documentation commensurate with the potential to have an environmental, safety, health, radiological, or quality impact. A methodology (as described in the [Graded Approach for Quality Requirements](#) SA) was developed to facilitate the application of the graded approach. The CFN Risk Management Plan addresses high-level project risks.

### **Scope of PQAP**

The CFN PQAP will address both the conventional and technical aspects of the project. The conventional aspects address project activities from design through construction. The technical aspects include selection and procurement of instrumentation, installation and startup. These activities are divided into the following major Work Breakdown Structure (WBS) elements, as shown in Figure 1.

## **WBS 1.1 Project Support**

Project support includes work necessary to manage the CFN in accordance with DOE O 413.1, "Project Management for the Acquisition of Capital Assets" and to perform engineering design, and engineering oversight of inspection, testing and startup for the other Level two WBS activities (Technical Equipment, Conventional Construction, Standard Equipment).

Requirements to assure project management performance are delineated in the DOE Order 413.3 and DOE M 413.3-1, "Project Management Manual". Specific implementing procedures and controls are described in the Project Execution Plan (PEP) for the CFN.

The requirements for assuring quality of engineering are fully integrated in the procedures for specification of technical equipment (WBS 1.2) and design and construction of conventional facilities (WBS 1.3), therefore discussion of the applicable quality assurance requirements, processes and procedures will be addressed in the discussion for those respective WBS activities.

## **WBS 1.2 Technical Equipment**

The primary scientific deliverable for the CFN is the research that will be conducted using state of the art instruments operating at nanometer scale (nanoscale, one billionth of a meter). Accordingly, a large fraction of the CFN project is budgeted for sophisticated "off-the-shelf" and customized scientific equipment. In some cases, equipment will be assembled into either fixed or flexible experiments. Additional funds are set aside to support specification, acquisition, assembly, installation and testing. Appropriate procurement controls, per SBMS requirements, will be applied to ensure the quality, delivery, and performance of the equipment. These controls include selection/evaluation of suppliers and quality-related performance requirements.

Technical equipment specifications originate with the 7 cluster leaders, who bring specialized technical expertise in the described areas. Coordination of equipment selection is the responsibility of the Technical equipment coordinators. Equipment specifications, installation requirements, and testing plans will be established in consultation with the project Technical Procurement manager and reviewed and approved by the project ESH&Q coordinator. Final approval, taking into account budgeting, scheduling, and scientific priority, is the responsibility of the Project Manager, with important input from the CFN director. NC Work Planning will cover



installation and acceptance. Both an Operational Readiness Evaluation (ORE) and the NC Experimental Safety Review process will govern a shakedown operation.

### **WBS 1.3 Conventional Construction**

Conventional construction provides the basic platform for nanoscale research. This will include the specialized laboratory spaces that will house the instruments, the supporting office spaces and extensive utility, mechanical and electrical systems that make up the CFN Building. This effort requires that the basic design and construction of the building will be overseen by the BNL Plant Engineering Division (EP), with architectural and engineering design provided by a contract with an architectural engineering firm (HDR). See Appendix 1 for HDR's "Design Team Program for Quality". EP uses the SBMS and its own internal procedures, as applicable, to perform design and construction. Using the processes and requirements delivered through SBMS, EP has established processes for planning, achieving, and assessing their activities. Thus EP's quality assurance program assures the quality of all aspects of Titles I, II and III.

### **WBS 1.4 Standard Equipment**

Standard equipment consists of furnishings for the building, including desks, chairs, desktop computers and office equipment. Computer acquisition is via an in-place contract with established vendor(s), on whose website specifications for hardware and software are suitable for desktop applications and connectivity at BNL.

Quality Assurance requirements for WBS 1.4, Standard Equipment, are addressed by the comprehensive requirements for WBS 1.3 Conventional Construction that govern design, specification, procurement, delivery, installation and inspection of standard equipment items.

### **WBS 1.5 Other Project Costs**

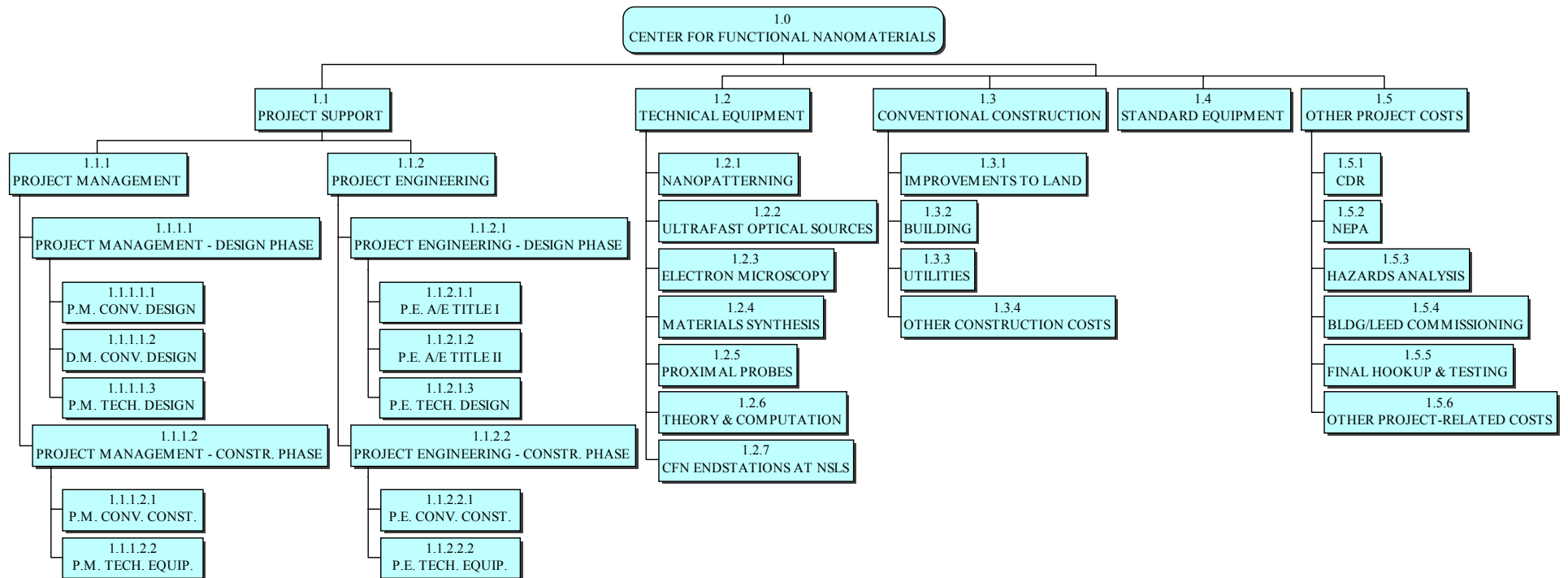
Other Project Costs identifies activities that are related to achieving the mission of the CFN project but are not funded by the CFN project capital funding (TEC). These activities include: development of the Conceptual Design Report (CDR), preparation of National Environmental Policy Act (NEPA) documentation, preparation of the Preliminary Hazards Analysis (PHA), certification of the CFN Building under US Green Building Council Leadership in Energy and Environmental Design program (LEED), and final commissioning of instruments in preparation for operations. Each of these activities utilizes processes and procedures that are used in design and construction of conventional facilities. Therefore, where specific implementation procedures are

required for these activities, they will be described under the implementing procedures for WBS 1.3 Conventional Construction.

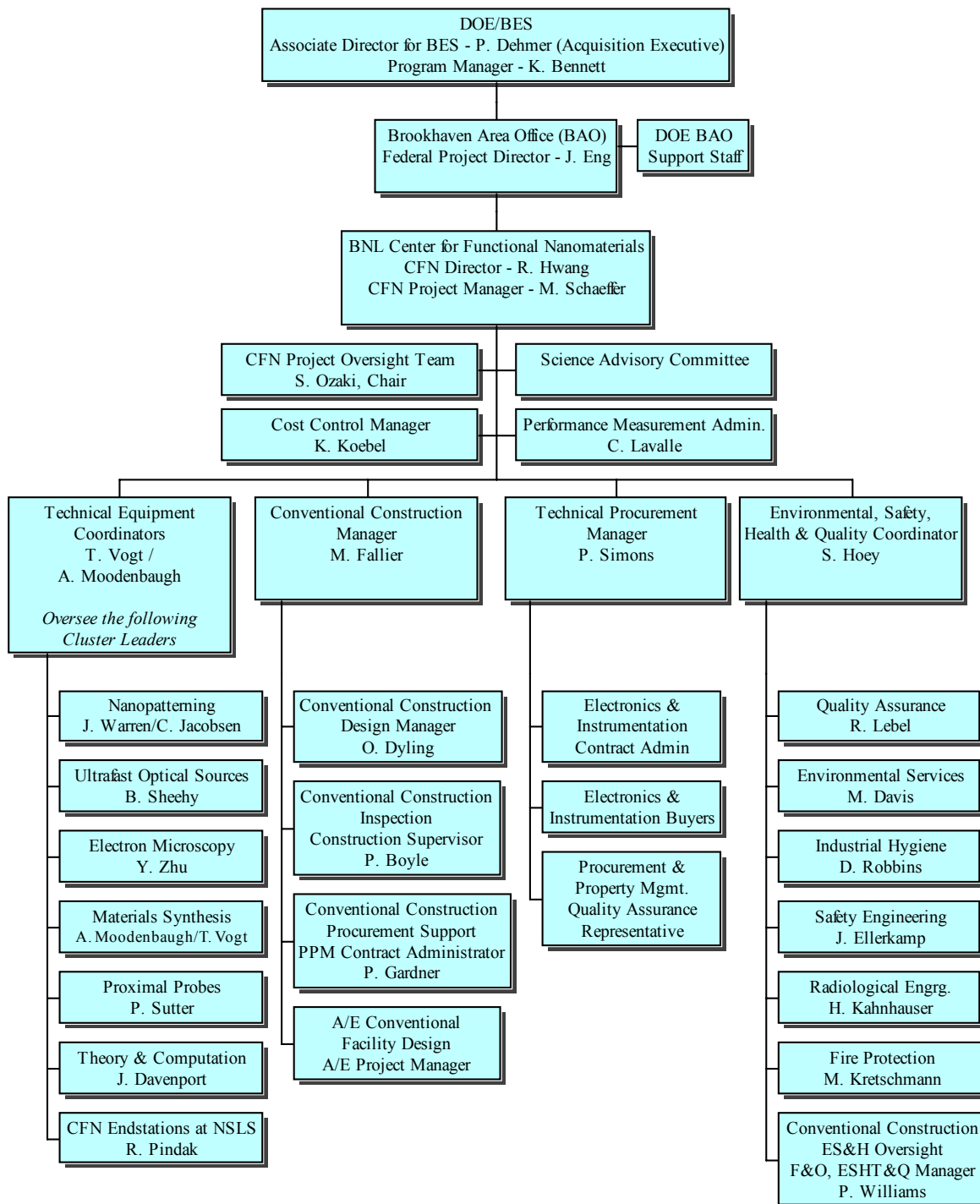
### **Responsibilities**

The ESH&Q Coordinator is directly responsible for oversight and development of the CFN PQAP and reports directly to the CFN Project Manager who has overall responsibility for implementing the CFN Project Quality program. The Quality Management Office Manager will assign a Quality Representative (up to a 0.25 FTE) to the CFN, who will assist the ESH&Q Coordinator and act as a resource for the CFN QA program implementation and verification. Individuals on the CFN project team are responsible and accountable for the quality of the work that they perform and/or supervise (see Figure 2).

**Figure 1**  
**Center for Functional Nanomaterials (CFN)**  
**Work Breakdown Structure (WBS)**



**Figure 2**  
**Center for Functional Nanomaterials (CFN)**  
**Project Organization**



## PROJECT QUALITY ASSURANCE PROGRAM (PQAP)

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The following sections describe how the 10 Criterion that comprise the DOE Order and Rule on Quality Assurance will be addressed for major WBS elements (Technical Equipment and Conventional Construction) and thus constitute the Project Quality Assurance Program. Each section addresses one criterion and is structured as follows:

1. DOE Quality Assurance Requirement

The DOE QA requirements for the criterion, quoted verbatim.

**Note:** The DOE QA requirements quoted are from DOE Order 414.1A, Quality Assurance.

2. Program Provisions

A description of which SBMS level documents address the criterion.

3. CFN Corresponding Implementing Procedures

A description of implementing procedures, for Technical Equipment and Conventional Construction, to the SBMS level documents. These implementing procedures are supplemental to the SBMS level ones.

## **Criterion 1 – Program**

### **DOE Quality Assurance Requirement:**

1. A written QAP must be developed, implemented, and maintained.
2. The QAP must describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing the work.
- 3 The QAP must describe management processes, including planning, scheduling, and resource considerations.

#### **1.1 Purpose**

This section defines the management, technical, and Quality Management organizations that will be responsible for the work performed in adherence with this PQAP for Technical Equipment, Standard Equipment and Conventional Construction.

#### **1.2 Program Provisions**

Work at the Laboratory is managed through a hierarchy of governing SBMS documents: [Policies](#), [Standards of Performance](#), [Management Systems](#), and [Subject Areas](#). Policies are the highest-level statements of the organization's philosophy for conducting business. Standards of Performance enforce the high-level practices by which BNL carries out its mission and policies. Management Systems represent the highest level of operating and business processes, and are designed to meet customers' expectations; Management Systems also identify scope, ownership, requirements and drivers, customers, outputs, system operations, and responsibilities. The Management Systems are implemented through Subject Areas, which provide procedures and guidelines. Laboratory-wide governing documents are delivered through the SBMS.

BNL's Quality Management System established a QA Program Description that is closely aligned with the Integrated Safety Management System and describes how BNL meets the requirements of DOE O 414.1A and 10 CFR 830 Subpart A. This program, as well as the Project QAP, is periodically reviewed. BNL deploys these requirements through multiple Management Systems that directly relate to the topics identified (e.g., training requirements are integrated into the [Training and Qualifications](#) (T&Q)

Management System). This integrative approach ensures the quality of activities in the daily operations of the Laboratory, and reinforces the understanding that quality is each individual's responsibility and an essential part of all work.

The CFN uses the SBMS and corresponding internal procedures, as applicable, to perform work within their organizations. Using the processes and requirements of SBMS, the CFN establishes processes for planning, achieving, and assessing its activities.

The Quality Representative will serve as "Quality" focal points to assist line management in implementing the PQAP. They have the authority and unlimited access — both organizational and facility (as personnel safety and training allow) — to assist their line managers in identifying potential and actual problems that could degrade the work.

The [Human Resources](#) Management System maintains the basic process used by the CFN's management to identify and document an employee's Roles, Responsibilities, Accountabilities, and Authorities (R2A2).

The [Integrated Planning](#) Management System provides a process that ensures clarity about CFN's resource investments, and unambiguously specifies the expected results, assigned resources, and accountability for management of those resources; it aligns investments with strategic goals and critical outcomes with those of BNL sponsors.

The [Work Planning and Control](#) Management System establishes the requirements for work planning and controls so that all work is planned and implemented properly, hazards and risks are identified and controlled, resources are scheduled and coordinated, and appropriate feedback mechanisms are in place. This system also covers the Experimental Safety Review process that is used by organizations that conduct experiments to identify the hazards, plan the work as well as the controls, and authorize the experiment.

The [Life Cycle Asset](#) Management System establishes requirements for facilities planning, engineering design, facilities management, maintenance and energy management. This management system, as implemented in EP's Policies & Procedures, has direct bearing on design, construction and transition to operations for the CFN. Note that the DOE RPAM Order 430.1B has been issued to supercede LCAM. BNL is in the process of revising the LCAM management system to address the requirements of RPAM in accordance with the implementation date of 9/30/04.

### **1.3 CFN Corresponding Implementing Procedures**

The CFN PQAP implements applicable procedures of the BNL SBMS and responsible department procedures as described herein.

## **Criterion 2 - Personnel Training and Qualification**

### **DOE Quality Assurance Requirement:**

1. Personnel must be trained and qualified to ensure they are capable of performing their assigned work.
2. Personnel must be provided continuing training to ensure that job proficiency is maintained.

### **2.1 Program Provisions**

The [Training and Qualifications \(T&Q\) Management System](#) supports CFN management in ensuring that personnel working at the CFN are appropriately trained and qualified to achieve the highest level of performance, to provide a safe and healthful workplace, and to protect the environment. The Training and Qualifications Management System accomplishes this by the following:

- Providing assistance to other management system stewards and Laboratory line management with identifying and satisfying customer, staff, and regulatory training and qualification needs
- Providing a documented Laboratory-wide training and qualification program, which includes standards, procedures, and guidelines

The hazards, risks, and job training and qualification needs associated with work are identified through job training assessment, work planning, and experimental review processes, and the appropriate controls and programs are instituted to address them. Training and qualification requirements are a control mechanism that plays an important role in determining strategies for integrated risk and hazard mitigation.

The [Work Planning and Control for Experiments and Operations](#) Subject Area, Work Permit Process, and/or the Construction Safety Management Processes (as defined in [ES&H Standard 1.3.1, Construction Safety](#)) ensure that CFN or non-CFN staff have the training/qualifications required for a given job. Work Planning and Control for Experiments and Operations screens all requests for work to determine hazards and controls, as well as any training/qualifications required for contractor personnel. If the level of hazard warrants, ES&H Standard 1.3.1 is invoked which states the minimum competency requirements for contractors must be detailed and provided to the Procurement and Property Management Division (PPM). PPM includes those



requirements in the bid and contract documents to qualify contractors for award. Also, ES&H Standard 1.3.1 calls for verification of the required training and qualification of the contractors.

The Work Planning and Control for Experiments and Operations Subject Area also ensures hazards associated with an experiment are reflected in the Job Training Assessments for staff and users/visitors/guests participating in experiments and/or setup or tear down. It also ensures experimental staff and users and/or non-CFN personnel receive the minimum required training to conduct an experiment safely.

Appropriate staff will be indoctrinated and trained on the requirements in this PQAP.

## **2.2 CFN Corresponding Implementing Procedures**

### **2.2.1 Technical Equipment**

The Technical Equipment coordinators and Cluster Leaders have their training requirements (JTAs) for tasks in this project established by the Project Manager after consultation with the ESH&Q Coordinator and the Technical Equipment coordinators. The training office will be notified of needed changes by the CFN Dept. training coordinator. These qualifications will be reviewed during the project as new tasks are assigned and/or SBMS requirements are changed. Training records are available online, and can be verified.

### **2.2.2 Conventional Construction**

The specific implementing procedures for assuring training qualifications of staff involved with design and construction of conventional facilities for the CFN will follow EP's training program. The EP training program is governed by EP Policies and Procedures including the specific requirements of EP-MGMT-700 Training Plan and EP-MGMT-710 Contractor/Vendor Training & Badging. All EP staff have a job training assessment (JTA) that identifies the minimum training and qualifications required to perform their job function. JTA's are reviewed annually by the supervisor/manager to assure they reflect current job requirements and are consistent with staff R2A2's. The status of training required to fulfill the JTA requirements are maintained in the training database and managed by the EP training Coordinator. The EP prepares monthly reports to supervisors and management to verify JTA training status of all staff.

Training of A/E design staff performing CFN design will be in accordance with the Design A/E's (HDR Architecture Inc.; see "Design Team Program for Quality" Appendix 1 for the CFN). EP will identify requirements for training of construction contractor staff, beyond established skill of the craft or trade, in the project specifications, where applicable. See Applicable Supplemental Procedures to SBMS Matrix Figure 3.

## **Criterion 3 – Quality Improvement**

### **DOE Quality Assurance Requirement:**

1. Processes to detect and prevent quality problems must be established and implemented.
2. Items, services, and processes that do not meet established requirements must be identified, controlled, and corrected according to the importance of the problem and the work affected.
3. Correction must include identifying the causes of problems and working to prevent recurrence.
4. Item characteristics, process implementation, and other quality-related information must be reviewed and the data analyzed to identify items, services, and processes needing improvement.

### **3.1 Program Provisions**

The [Integrated Assessment Program](#) (IAP) is BNL's performance-measurement system. The IAP consists of four primary elements: Peer Review, Self-Assessment, Independent Oversight, and Internal Audit. As such, the IAP does the following:

- Provides information on operational (including environment, safety, and health), technical, and business performance to ensure the early identification and resolution of problems.
- Contributes to ongoing improvement in performance.
- Verifies the expectations and requirements of stakeholders and customers to improve scientific and technological research, existing products and services, and enhance customer satisfaction.
- Verifies conformance to established internal and external requirements.

Together, the IAP elements generate information on scientific, business, and operational performance for CFN's management, staff, customers, and stakeholders and also provide mechanisms for improving quality.

BNL's [Lessons Learned Program](#) reviews operating experiences, both at BNL and off-site. In addition, it includes special studies and investigations, Occurrence Reporting and Processing System (ORPS) Reports, and incidents under the Price-Anderson

Amendments Act (PAAA). Lessons Learned are disseminated to the CFN Lessons Learned Coordinator.

The Laboratory established the [Assessment Tracking System](#) (ATS) as the Laboratory-wide vehicle to manage and respond to assessment results.

The [Nonconformances, Identifying and Reporting](#) Subject Area provides a consistent approach to handling nonconformances (identifying and processing, including appropriate documentation). The SA provides means to control further processing and testing of nonconforming or defective items pending disposition, especially when identified at incoming inspection/testing. In addition, nonconforming or defective items found at incoming inspection/testing are reported directly to Procurement and Property Management Division (PPM), which can assist in the disposition of the item.

The [Corrective and Preventive Action](#) Subject Area is followed to analyze the nonconformance using causal analysis and determine what appropriate corrective and preventive actions are to be taken.

### **3.2 CFN Corresponding Implementing Procedures**

#### **3.2.1 Technical Equipment**

None.

#### **3.2.2 Conventional Construction**

The specific implementing procedures for assuring quality improvement for the CFN will follow EP's quality assurance program. These procedures document established systems that will identify design, construction and procurement activities that do not meet desired quality objectives and will lead to the corrective action necessary to bring the activity or item into compliance with quality objectives. They also govern procedures for design review, value engineering, testing and inspection, nonconformance reporting and resolution, contractor evaluation and work planning and control. See Applicable Supplemental Procedures to SBMS Matrix Figure 3.

## **Criterion 4 - Documents and Records**

### **DOE Quality Assurance Requirement:**

1. Documents must be prepared, reviewed, approved, issued, used, and revised to prescribe processes, specify requirements, or establish design.
2. Records must be specified, prepared, reviewed, approved, and maintained.

#### **4.1 Program Provisions**

##### **Documents**

If the CFN requires any project-specific procedures to supplement an SBMS document, they will be developed following the [Internal Controlled Document](#) SA.

##### **Records**

The purpose of [Records Management](#) Subject Area is to plan and implement a cost-effective system to identify, preserve, and make available the documentation created or received during the operation of the Laboratory and the conduct of business. The Records Management System (see the [Records Management](#) Management System Description) ensures that record information is controlled, maintained, and disposed of in compliance with legal requirements and Department of Energy requirements. Records may be in the form of paper, electronic, or other media.

This subject area covers the identification of records, filing and maintenance of records, inventory of records, and storing and disposing of record materials.

Records shall include the results of reviews, inspections, tests, audits, monitoring of work performance, personnel qualification, design specifications, and procurement documents. The records shall be indexed and appropriately identified to permit reference of the item or activity to which it applies.

CFN Project documents will be controlled, retained and filed in the CFN Project Office under the direct responsibility and supervision of the CFN Project Manager. The CFN Project manager will be responsible for oversight of project record documents to comply with SBMS requirements. As directed by the CFN Project Manager, sub-tier documents and records prepared by individual Project managers may be retained in the CFN project files maintained at the Project manager's work location. These sub-tier files must also comply with SBMS requirements and the specific document requirements of the CFN project under the supervision of the Project level two manager.

## 4.2 Controlled Distribution

The distribution of the Project Quality Assurance Program will be controlled. The following is a list of the controlled copies.

Copy Holder	Controlled Copy Number
CFN Project Manager (Original)	1
CFN Director	2
CFN Conventional Construction Manager	3
CFN ESH&Q Coordinator	4
CFN Technical Equipment Coordinator	5

## 4.3 CFN Corresponding Implementing Procedures

### 4.3.1 Technical Equipment

Records retention for technical equipment will follow EP project file procedures (see Figure 3) to assure that design, specification, performance, procurement contracts, progress payments, shop drawing review and approval, pre-delivery testing, installation drawings, operation and maintenance data, initial commissioning test results, and acceptance basis are all documented and maintained in the project record.

### 4.3.2 Conventional Construction

The specific implementing procedures for assuring proper preparation, review, approval, update, and record retention for conventional construction will be governed by applicable EP Policies and Procedures. The EP policies and procedures are controlled documents wherein the only current versions are accessible by web. Preparation, review, and approval of these documents are controlled within EP and the Facilities & Operations Safety, Health, Training and Quality office. There are numerous procedures within the EP Policy and Procedure set that relate to controls of documents and records. Among the most critical are: EP-MGMT-155 Configuration Control which governs compliance with configuration control and as-built record requirements; EP-E&CS-007 Engineering Design Standard Forms which standardizes the communication, format, review and approval of various record documents; EP-E&CS-009 Project File which governs which documents are part of the project record and how they are to be handled and maintained; and EP-ESH-500 Project Environmental, Safety and Health Review which governs ES&H review requirements and approvals for design and construction projects. Additional relevant procedures are indicated in the Applicable Supplemental Procedures to SBMS Matrix Figure 3.

## **Criterion 5 - Work Processes**

### **DOE Quality Assurance Requirement:**

1. Work must be performed to established technical standards and administrative controls, using approved instructions, procedures, or other appropriate means.
2. Items must be identified and controlled to ensure their proper use.
3. Items must be maintained to prevent their damage, loss, or deterioration.
4. Equipment used for process monitoring or data collection must be calibrated and maintained.

### **5.1 Program Provisions**

The WP&C Management System provides work planning and control requirements to ensure that work is properly planned and executed, hazards and risks are identified and controlled, resources are scheduled and coordinated, and appropriate feedback mechanisms are in place. A graded approach is used ([Graded Approach for Quality Requirements](#) Subject Area) to apply a level of planning rigor and quality control that is commensurate to the level of ESH&Q issues, job complexity, and work coordination. The WP&C Management System established three processes to control work: (1) Work Planning and Control for Experiments and Operations Subject Area, (2) Project Management Standard, and (3) Internal Controlled Documents Subject Area (standard operating procedures). All of these processes have the ISM Core Function steps and Quality issues integrated into the required way of conducting business. The WP&C Management System uses input from Integrated Assessment, [Facility Safety](#), [Worker Safety & Health](#), [Environmental Management System](#), and other management systems to support the processes in identifying, analyzing, and controlling ESH&Q hazards and concerns.

The [Life Cycle Asset Management](#) System establishes the requirements for controlling and maintaining real property, equipment items, and the site infrastructure. The real property and maintenance management systems provide the processes to prevent damage, loss, or deterioration to the site assets.

The [Calibration](#) Subject Area addresses the identification of equipment to be calibrated and the related calibration requirements. The frequency and rigor of calibration of the equipment items is tailored according to the potential ESH&Q impact. Measuring or test

equipment used to monitor processes or generate data important to the project or activity, is calibrated and maintained.

The [Materials Requiring Special Handling \(Including Age Sensitive Material\)](#) Subject Area establishes procedures for preventing damage and minimizing deterioration during the handling and storage of items and material, especially age sensitive material.

CFN management delegates authority to all employees to "Stop Work" to avoid unsafe work practices. In addition, worker participation is included in the tenets of self-assessment and feedback processes in the Laboratory's programs.

## **5.2 CFN Corresponding Implementing Procedures**

### **5.2.1 Technical Equipment**

Work associated with experimental equipment installed during the CFN project will be subject to BNL Work planning. The NC Department ESH&Q structure will be the basis for Work Planning controls and Experimental Safety Reviews in this phase of the project. Work permits will be required for lab utility and technical equipment installations, to be approved by the building manager. The NC Experimental Safety Review committee will be appointed prior to receipt of equipment to conduct Experimental Safety Reviews for initial startup and acceptance testing, as well as for subsequent experimental work. A Facility Support Representative, an Industrial Hygienist, and an Environmental Compliance Representative will be assigned to NC. A Quality Representative and Training Coordinator will be appointed for the department. Materials entering the building will, as appropriate, be tracked by the Chemical Management System (CMS). Individual Cluster leaders will be responsible for keeping CMS records accurate. The ESH&Q and the Tech Equipment Coordinators will assure that the chemicals residing within the building are within the applicable building code envelopes. Equipment used for measurement and testing will be calibrated; for example, balances (mass), thermocouples (temperature), NIST magnetic standards, and NIST x-ray diffraction standards.

### **5.2.2 Conventional Construction**

Specific implementing procedures to prescribe, control, monitor and assess work processes for design and construction of conventional facilities are fully described by



the EP Policies and Procedures (See Applicable Supplemental Procedures to SBMS Matrix Figure 3)

Design and construction of the CFN will be implemented using these documented work processes. Also note that these work processes are integrated and compliant with the overarching requirements of the SBMS and ISM.

## **Criterion 6 - Design**

### **DOE Quality Assurance Requirement:**

1. Items and processes must be designed using sound engineering/scientific principles and appropriate standards.
2. Design work, including changes, must incorporate applicable requirements and design bases.
3. Design interfaces must be identified and controlled.
4. The adequacy of design products must be verified or validated by individuals or groups other than those who performed the work.
5. Verification and validation work must be completed before approval and implementation of the design.

### **6.1 Program Provisions**

Currently several management systems (e.g., Life Cycle Asset Management, Quality Management, Work Planning and Control, and Facility Safety) include requirements regarding design. The [Engineering Design](#) Subject Area provides processes for identification, documentation, control, and verification of engineering design baselines. The CFN uses these processes to ensure that the necessary standards, codes, or engineering/scientific principles are defined in the design documentation, including the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions.

The design documentation, including any changes, incorporates the applicable requirements and design bases. Design interfaces are identified and controlled. The adequacy of these designs is verified or validated by appropriate individuals or groups, other than those who performed the work. When verification and validation are completed, the design is then approved and implemented.

Specifications, drawings, and other design documents are prepared to define the design parameters. These documents present a verifiable engineering definition of a part, component, assembly or process.

The [Software Quality Assurance](#) (SQA) Subject Area provides a systematic effort to prove that a software product is acceptable for use. SQA is based on the premise that software quality must be defined and implemented early in the software development

cycle. Consequently, its success is dependent not only on planning, but also on the involvement and support of the administrative and technical staff responsible for defining specifications, design, management, coding, maintenance, and testing of the software. Note that software development for the CFN is limited to customization of networking and communication protocols related to the Theory and Computing Cluster. All other software involves programming of existing commercially available proprietary software such as that used for building automation and energy management.

## **6.2 CFN Corresponding Implementing Procedures**

### **6.2.1 Technical Equipment**

The SBMS “Software Quality Assurance” subject area “does not apply to software used for basic scientific research and development activities unless those activities have environmental, safety, or health impacts.” It is anticipated that most software developed and implemented will fall into this exemption category. Technical Equipment Coordinators will review CFN software with cluster leaders. Software projects that have the potential to fall outside this exemption will be evaluated by the ESH&Q coordinator. The required Software Quality Assurance procedures, encompassing training, controlled documents, and work planning, are detailed in the SBMS subject area. Any software that is determined not to be exempt will be controlled per the SQA Subject Area.

### **6.2.2 Conventional Construction**

In addition to the SBMS Engineering Design Subject Area, Conventional Construction design will follow the design procedures of the EP Policies and Procedures as listed in Applicable Supplemental Procedures to SBMS Matrix, Figure 3, and the contracted design A/E firm (HDR) document “Design Team Program for Quality”, Appendix 1. Included in EP’s engineering design QA program, will be design of workstations and specification of office furnishings required under WBS 1.4 Standard Equipment.

## **Criterion 7 - Procurement**

### **DOE Quality Assurance Requirement:**

1. Procured items and services must meet established requirements and perform as specified.
2. Prospective suppliers must be evaluated and selected on the basis of specified criteria.
3. Processes to ensure that approved suppliers continue to provide acceptable items and services must be established and implemented.

#### **7.1 Program Provisions**

The [Acquisition Management](#) System provides support for purchasing services, materials, equipment, and supplies for the CFN project. The system includes provisions, as required, for:

- Source evaluation and selection,
- Objective evidence of quality furnished by the supplier or contractor,
- Source inspection, audit, or surveillance; and
- Examination of items or services upon delivery.

As such, the Acquisition Management System provides internal customers with quality products and services in a timely manner at the lowest cost of ownership, i.e., "best value," by using best commercial practices; and ensuring that acquisitions are conducted in compliance with the prime contract, applicable statutes and regulations, and in accordance with the highest ethics and standards.

The Acquisition Management System ensures that appropriate requirements are incorporated into subcontracts, i.e., Quality Assurance, Integrated Safety Management, and other ES&H requirements flow down to all subcontractors. Additionally, an Acquisition Management System process requires that those individuals submitting a requisition for contracted services or supplier items perform a hazard and risk screening to ensure that appropriate controls are evaluated and put in place, which may then trigger additional procurement considerations. The [Purchase Requisition Review for Quality-related Requirements](#) Subject Area provides a methodology for selecting and applying quality-related requirements to be imposed upon a supplier.

The Acquisition Management System processes ensure that procured items and services meet the established requirements, perform as specified, and meet the expectations of the end user. The need for inspection and acceptance testing is determined during project or activity planning, based on the graded approach ([Inspection and Acceptance](#) Subject Area). In addition, the system ensures that suppliers are evaluated and selected on the basis of specified criteria. The stringency of the procurement requirements is commensurate with the importance of the purchased items or services to the project or activity.

Based on the "graded approach," potential suppliers of critical, complex, or costly items or services undergo an evaluation, before contract award, to determine if they can consistently conform to the technical and quality requirements of the procurement. The [Evaluation of Seller Quality Assurance \(QA\) Programs](#) Subject Area is followed to perform the evaluation. The evaluation may include a review of the supplier's history with BNL or other DOE facilities, a pre-award survey of the supplier's facility, and a review of other supplier data, i.e., DOE-sponsored Supplier Quality Information Group. An evaluation cannot be based solely on a review of current ISO, ASME or other certifications, but must include at least one other evaluation method. Appropriate subject matter experts perform evaluations.

The Acquisition Management System includes a post-award administration process that ensures that subcontractors and suppliers satisfy contract requirements. This system also provides mechanisms to monitor supplier's performance through feedback from requisitioners who received nonconforming material. This information is periodically reported, based on the importance, complexity, and quantity of the product or services.

## **7.2 CFN Corresponding Implementing Procedures**

### **7.2.1 Technical Equipment**

The early identification of a CFN-specific Technical Procurement Manager promotes the efficient attainment of DOE procurement QA requirements. Major prospective suppliers have been identified early in the CFN project (CFN Title I Design Report). Development of criteria to choose suppliers and acceptance procedures will be developed by the Technical Procurement Manager based on information gathered by cluster leaders and the technical equipment coordinators.

### 7.2.2 Conventional Construction

Quality assurance requirements for procurements as part of conventional construction are governed by the applicable SBMS requirements for procurement, applicable BNL Procurement & Property Management Division implementing procedures, and EP policies and procedures (see Applicable Supplemental Procedures to SBMS Matrix Figure 3) for procuring contracted services.

The primary procurements under this activity are procurement of Architect/Engineer services, procurement of a commissioning contractor and procurement of a general construction contractor. In addition, this activity will include procurement of standard equipment (WBS 1.4) on a furnish and install basis. Existing procedures define the methods for source selection, performance verification and documentation for these procurements.

## **Criterion 8 - Inspection and Acceptance Testing**

### **DOE Quality Assurance Requirement:**

1. Inspection and testing of specified items, services, and processes must be conducted using established acceptance and performance criteria.
2. Equipment used for inspections and tests must be calibrated and maintained.

### **8.1 Program Provisions**

The [Quality Management System](#) provides processes for the inspection and acceptance testing of an item, service, or process against established criteria to determine acceptability. The need for inspection and acceptance testing is determined during project or activity planning, based on the graded approach ([Inspection and Acceptance Subject Area](#)).

Where required for key, complex, or critical inspection/test activities, acceptance and performance criteria are developed and documented. If an item is nonconforming, it is identified to prevent its inadvertent use. These processes also specify how inspection and test status (i.e., accept, reject) will be indicated either on the item itself, or on documentation traceable to the item.

Designated inspections/tests are performed using equipment that is calibrated and maintained; the Calibration Subject Area describes the calibration process for measuring and test equipment. The CFN will identify appropriate equipment requiring calibration. The calibration status is readily discernible and associated calibration procedures, documentation, and records are prepared and maintained. Calibrated equipment is properly protected, handled, and maintained to preclude damage that could invalidate its accuracy. Measuring and test equipment that is found out of calibration is identified and its impact evaluated.

### **8.2 CFN Corresponding Implementing Procedures**

#### **8.2.1 Technical Equipment**

The specific inspection and testing requirements for Technical Equipment acquired as part of the CFN project will be incorporated as part of the purchase specifications for individual items.

### 8.2.2 Conventional Construction

Standard inspection and acceptance testing requirements applicable to conventional construction are defined in the EP Policies and Procedures (see Applicable Supplemental Procedures to SBMS Matrix Figure 3). Additional quality assurance inspection and testing will be defined as required and identified during the engineering design process and will be indicated in the construction specifications and the commissioning plan. The use of a commissioning contractor represents a significant additional investment in enhanced quality assurance for inspection and testing of important CFN systems. The commissioning plan will identify applicable test and performance acceptance criteria.

Actual inspection and testing requirements will be carried out by BNL construction inspection staff, HDR Architects field inspection staff, the commissioning agent contracted by BNL, and, where directed in the contracts, by contractor or equipment vendor staff. Instruments used for inspection and testing will be verified for compliance with applicable calibration protocols identified in the specific test procedures and commissioning plan.



## **Criterion 9 - Management Assessment**

### **DOE Quality Assurance Requirement:**

1. Managers must assess their management processes.
2. Problems that hinder the organization from achieving its objectives must be identified and corrected.

#### **9.1 Program Provisions**

The performance of assessments is controlled by the self-assessment element of the [Integrated Assessment Program](#). Provisions within the IAP supply the CFN with feedback processes to support performance-based management. Self-assessment, an element of IAP, responds directly to management assessment requirements.

Appropriately trained personnel shall perform assessments. Assessing personnel shall document the assessment results. CFN management and staff shall review the results and take necessary action to correct any deficiencies revealed by the assessment.

Assessments shall be performed:

- To provide an objective evaluation of compliance with established requirements, methods, and procedures;
- To assess adequacy of CFN Project QAP performance; and
- To verify implementation of appropriate corrective actions.

#### **9.2 CFN Corresponding Implementing Procedures**

As required in the CFN PEP, the CFN project will be formally reviewed by senior BNL management each month to assure that performance of CFN systems is meeting objectives and, if necessary, to identify any corrective action required. Each quarter the CFN performance will be assessed by the DOE Federal Project Director and by cognizant DOE Program Management (Office of Basic Energy Sciences). In addition to the management assessment requirements of the SBMS, the CFN project has established a BNL CFN Project Oversight team that will perform annual (or more, if deemed necessary) assessments of the CFN project's performance and management systems. The reviews and assessments above are comprehensive and assess all CFN Project WBS areas. The assessments will include review of CFN project management, QA, engineering, the science program mission and facilities requirements. See Applicable Supplemental Procedures to SBMS Matrix Figure 3.

## **Criterion 10 - Independent Assessment**

### **DOE Quality Assurance Requirement:**

1. Independent assessments must be planned and conducted to measure item and service quality, to measure the adequacy of work performance, and to promote improvement.
2. The group performing independent assessments must have sufficient authority and freedom from the line to carry out its responsibilities.
3. Persons conducting independent assessments must be technically qualified and knowledgeable in the areas assessed.

#### **10.1 Plan Provisions**

Provisions within the IAP Management System provide for independent assessment of CFN operations. Through this management system, an institutional independent assessment function is achieved through the Internal Audit and Oversight Office. This office is a functionally independent organization that provides appropriate expertise to provide management with an independent assessment of a wide spectrum of business systems and operations. Additional expertise is acquired if necessary to support the assessment scope.

The Internal Audit and Oversight Office provides independent assessments of business and financial processes and operational activities. The scope of these assessments includes evaluation of specific operational concerns identified by senior management. The office also performs Special Studies, which are directed by senior management in response to trends or events that indicate a significant risk associated with any aspect of operations.

The need for independent assessments is determined by senior Laboratory and CFN management, who consider factors such as past performance, adherence to the Laboratory mission, risk minimization, and lessons learned from other institutions.

The BSA Board of Directors also periodically schedules and conducts "corporate oversight" assessments of Laboratory operations. Corporate oversight activities typically convene a team of knowledgeable individuals and peers, from other DOE sites as well as other institutions represented on the BSA Board of Directors.

Independent assessment is also manifested by third-party registration, e.g. site-wide registration to ISO 14001 for the Laboratory's Environmental Management System.

Regulatory bodies, funding agencies, and others (DOE, EPA, state and county agencies) also perform external assessments that provide an objective view of performance and as a result contribute to the independent assessment process of activities. CFN management evaluates the results of these assessments in determining the performance. Since such assessments are not under the control of CFN, they are not necessarily considered as being part of the independent assessment criterion. In considering the scope of planned management and independent assessments, Laboratory management determines external assessment results and schedules.

For all independent assessment activities, the appropriate manager tracks and addresses all corrective actions, issues, and conditions.

## **10.2 CFN Corresponding Implementing Procedures**

### **10.2.1 Technical Equipment**

A Scientific Advisory Committee (SAC), consisting of scientists external to BNL, will be appointed to provide guidance for and evaluate the effectiveness of the CFN scientific program. The SAC is expected to guide the science program, evaluating the quality of the CFN laboratory facilities and the equipment acquired as part of the CFN Project.

### **10.2.2 Conventional Construction**

CFN project management compliance will be assessed by the following: independent assessments as required by DOE O 413.3, including Energy System Acquisition Advisory Board reviews at Critical Decisions 2, 3, and 4; an External Independent Review (EIR); an independent cost estimate at the end of Title I design; and an Independent Project Review at the end of Title II design. These reviews include in their charge, an assessment of the effectiveness of the project's management systems. See Applicable Supplemental Procedures to SBMS Matrix Figure 3.

**Figure 3**  
**EP's Applicable Supplemental Procedures to SBMS Matrix**

Criterion	Procedure No.	Procedure Title
Program	None Applicable	None Applicable
<b>Personnel Training &amp; Qualification</b>	EP-MGMT-700 EP-MGMT-710 EP-MGMT-710B EP-MGMT-711	<a href="#">Training Plan</a> <a href="#">Contractor/Vendor Training &amp; Badging</a> <a href="#">Contractor/Vendor ID Badge Application Authorized Signatures</a> <a href="#">Site Access for Union Representatives</a>
<b>Quality Improvement</b>	EP-MGMT-411 ESHTQ-QA-101 E&CS-310	<a href="#">Non-Conformance Reporting</a> <a href="#">Corrective Action Tracking System</a> <a href="#">Construction Contractor Evaluation</a>
<b>Documents &amp; Records</b>	EP-MGMT-150 EP-MGMT-151 EP-MGMT-154 EP-MGMT-155 E&CS-007 E&CS-008 E&CS-009 E&CS-011 E&CS-010 E&CS-300 E&CS-304 E&CS-305 E&CS-306 E&CS-307 E&CS-309	<a href="#">Procedure Set Transition Management</a> <a href="#">Preparation of Policies and Procedures</a> <a href="#">Records Management System</a> <a href="#">Configuration Control</a> <a href="#">Engineering Design Standard Forms</a> <a href="#">Original Drawings</a> <a href="#">Project File</a> <a href="#">Classified Plant Protective Upgrade (PPU) Documents</a> <a href="#">Microfilming</a> <a href="#">Shop Drawing and Submittal Review and Approval</a> <a href="#">Daily Construction Reports</a> <a href="#">Field Changes</a> <a href="#">Contract Change Orders</a> <a href="#">As-Built Drawings</a> <a href="#">Engineering Change Notice</a>
<b>Work Processes</b>	E&CS-001 E&CS-002 E&CS-003 E&CS-004 E&CS-005 E&CS-057 E&CS-303 EP-ES&H-006 EP-ES&H-007	<a href="#">Project Organization</a> <a href="#">Project Coordinator</a> <a href="#">Project Lead Discipline</a> <a href="#">Project Support Disciplines</a> <a href="#">Work Flow Diagrams</a> <a href="#">Project Execution Plan</a> <a href="#">Construction Inspector</a> <a href="#">Work Planning &amp; Control System</a> <a href="#">Stop Work</a>

Criterion	Procedure No.	Procedure Title
Design	E&CS-056	<a href="#">Engineering Design Plan</a>
	E&CS-007	<a href="#">Engineering Design Standard Forms</a>
	E&CS-008	<a href="#">Original Drawings</a>
	E&CS-009	<a href="#">Project File</a>
	E&CS-013	<a href="#">Design Calculations</a>
	E&CS-100	<a href="#">Design Criteria</a>
	E&CS-101	<a href="#">Project Scope Changes</a>
	E&CS-200	<a href="#">Construction Specification Typing Requests</a>
	E&CS-201	<a href="#">Estimating</a>
	E&CS-202	<a href="#">Addendum</a>
	E&CS-203	<a href="#">Standard Specifications</a>
	E&CS-208	<a href="#">Detailed Design Review Process</a>
	E&CS-300	<a href="#">Shop Drawing and Submittal Review and Approval</a>
	E&CS-305	<a href="#">Field Changes</a>
	E&CS-306	<a href="#">Contract Change Orders</a>
	E&CS-307	<a href="#">As-Built Drawings</a>
	E&CS-309	<a href="#">Engineering Change Notice</a>
	PC-311	<a href="#">Review and Approval of Contractor Submittals</a>
	EP-ES&H-400	<a href="#">Fire Safety Program</a>
	EP-ES&H-500	<a href="#">Project Environmental, Safety and Health Review</a>
Procurement	EP-MGMT-412	<a href="#">Equipment Rental</a>
	E&CS-050	<a href="#">A/E Selection</a>
	E&CS-202	<a href="#">Addendum</a>
	E&CS-309	<a href="#">Engineering Change Notice</a>
	EP-MGMT-506	<a href="#">Calibration System</a>
Inspection & Acceptance Training	E&CS-303	<a href="#">Construction Inspector</a>
	E&CS-304	<a href="#">Daily Construction Reports</a>
	E&CS-305	<a href="#">Field Changes</a>
	E&CS-307	<a href="#">As-Built Drawings</a>
	E&CS-320	<a href="#">Soil Testing</a>
	E&CS-321	<a href="#">Structural Concrete</a>
	E&CS-322	<a href="#">Structural Steel</a>
	EP-ES&H-700	<a href="#">Elevators</a>
	EP-ES&H-702	<a href="#">Mobile Cranes &amp; Boom Trucks</a>
	EP-ES&H-703	<a href="#">Overhead Cranes</a>
	EP-ES&H-704	<a href="#">Overhead Hoists (Shop Cranes &amp; A-Frames)</a>
	EP-ES&H-706	<a href="#">Slings, Rigging Accessories, &amp; Lifting Devices (Below the hook)</a>
	EP-ES&H-801	<a href="#">Excavation</a>
	EP-ES&H-802	<a href="#">Scaffolding</a>
	EP-ES&H-803	<a href="#">Concrete and Masonry Penetrations</a>
	EP-ES&H-804	<a href="#">Fall Protection</a>
	EP-ES&H-820	<a href="#">EP-ES&amp;H-820: Contractor Safety Inspections</a>
	PC-311	<a href="#">Review and Approval of Contractor Submittals</a>
	PC-320	<a href="#">Quality Control and Inspection</a>
Management Assessment	EP-MGMT-503	<a href="#">Assessor Requirements</a>
	F&OP-MGMT-300	<a href="#">Self Assessment Program Description</a> As Defined in PEP
Independent Assessment	F&OP-MGMT-300	<a href="#">Self Assessment Program Description</a> As Defined in PEP

**APPENDIX 1**  
**Design Team Program for Quality**  
**(HDR Architecture, Inc.)**

## DESIGN TEAM PROGRAM FOR QUALITY

### QUALITY AWARENESS

Design excellence is predicated on two key ingredients: the quality of the staff assigned to the project and the awareness of each team member of the project objectives. Whether lead designer, technician or consultant, each participant must be committed to the idea that quality is inherent in the accomplishment of every project task.

While HDR can be sure of each team member's resolve to produce the finest facilities anywhere, we recognize that the sheer number of individuals and ideas generated introduces a need to maintain overall control of the design process. HDR has developed and implemented a QA/QC plan provides control and a high level of integration of the design concepts. The following items are the basis of a our Quality Program:

- Planning occurs throughout the program and guides us toward the delivery of quality professional services.
- Organize and structure tasks that must be accomplished to produce the desired objective. The clear assignment of responsibility and authority is the beginning of the implementation of a Program for Quality.
- Training of personnel to perform the desired tasks.
- Coordinating performance of each task
- Monitoring and measuring of actual results allowing consistency with the planned result.
- Good communication between all parties associated with the project and a well-structured coordination effort are essentials to a successful project.
- Documenting and recording all pertinent decisions, correspondence and actions will be in a central project file available to all team members.
- Providing feedback and objective critiquing of the design and process during Quality Control Reviews.

### GOALS OF THE QA/QC PLAN

The goal of the QA/QC plan is to help the design team continuously improve our service to Brookhaven National Laboratory (BNL) such that the design solution satisfies or exceeds the needs and criteria of the scientific community users, BNL management, and other key participants. HDR's QA/QC program provides guidance so that the project goals are met, and that our documents are of high quality and well coordinated. This plan is consistent with the *Vision* and *Mission* of HDR and is as integral part of the HDR design process.

## ACTIVITIES OF A QA/QC PLAN

### Specific steps of the plan

#### **A. Budget Tracking**

- All drawing sheets need to be identified and a tabulation of sheets or a sheet count prepared concurrent with the budget. Purpose is to determine compatibility of the budget and project size and to resolve any discrepancy before work begins.
- Details of the contract shall be reviewed with the owner and with the team members so that the whole team has a complete understanding of the Project Scope.

#### **B. Project Schedule**

- Review Project Commitments – Work priorities need to be established by Department Managers with the Team Leader/Project Manager and Section Managers for the project.
- Review to Project Schedule – Project schedule will be measured against man-hour effort computed in budget analysis, for tracking the project schedule.

#### **C. Tracking Construction Budget**

HDR will work with a qualified estimating consultant to provide the desired project goals within the construction budget. This will be accomplished by the following:

- At each milestone phase of the project HDR and the estimating consultant will produce a updated estimate reflecting the current state of the design.
- HDR will be in contact with the estimating contractor on a regular basis and will update them as design changes occur so that HDR can check on the construction costs as the design becomes more refined.
- During the design process HDR and the estimating consultant will track the design changes. HDR will inform the owner of any issues that may affect the construction budget either adversely or positively.

#### **D. Project Control and QA/QC**

Without proper project control, situations leading to shortcutting and elimination of Quality Control resulting in undetected errors may occur. The interaction between HDR and BNL is critical to the success of the project control being maintained. Project control will be achieved by use the following:



- Monthly Project Review Meetings with BNL, this will encourage process improvement, communications and help maintain focus.
- Between the monthly review meeting HDR will maintain a constant dialog with the owner on a weekly basis minimum to ensure that design changes, coordination and action items are address on a timely fashion.
- Milestone Review Meetings with BNL during all phases of the project.
- Maintenance of a tracking form that allows the Team Leader/Project Manager to track changes and comments from both HDR and BNL.
- Meeting Minutes of all project review meetings and design planning meetings. These minutes will indicate action items, responsible person, and the date the action item is due.
- Conference Calls between HDR and BNL to ensure that the design decisions being made are communicated to BNL on a timely basis.

#### **E. Interdisciplinary QA/QC**

The constant project reviews and coordination between disciplines during the design process is more important to maintaining Project Control than the document checking that is done at the conclusion of each design phases. This requires 'day-to-day' interaction among HDR team members regarding project-related issues, concerns and alternate solutions to the 'issues of the day'. This coordination happens in several ways, some formal and some informal methods are employed to accomplish this. These methods will include:

- Bi-weekly Design Team Meetings with in-house staff and staff from other offices.
- "Over-the board" critiques by senior HDR staff and senior project team members and team members directly responsible for the design and documentation.
- Impromptu meetings at design workstations with team members from different disciplines.
- Conference calls between offices or consultants to discuss specific design issues.
- In-House Pier Reviews are done at the conclusion of the major phase to provide a measuring point related to similar project completed project to ensure HDR is maintaining a Quality work and that the project is on track with the project goals.
- HDR has a "Ready-Check" group that it uses for doing in-house QA/QC cold reviews to aide in maintain a quality product.

Providing feed back and objective criteria of reviews such as document checking, design calculations, etc. is a duty of the project team. Even with reviews, the project team and the Project Manager remain responsible and accountable for their services and their participation in the project.

**F. HDR/Consultant QA/QC**

Methods for coordinating documents between HDR and HDR's consultants, focuses on the exchange and sharing of project information and documents.

Exchange of drawings, face to face team member contact, telephone conversations, transmittal of documents via facsimile, and utilization of identical building plan background drawings all play an important role in document coordination. Additionally, consultant drawings are assimilated into HDR produced documents and checked together utilizing the review process described within this document.

Face-to-face HDR/consultant meetings take place. These focus on the exchange of vital project information during the contract documentation phase.